

# Artificial Gravity Research Project

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Protecting the health, safety, and performance of exploration-class mission crews against the physiological deconditioning that results from long-term weightlessness during transit and long-term hypogravity during surface operations will require effective, multisystem countermeasures. Artificial gravity (AG)—which would replace terrestrial gravity with inertial forces generated by rotating the transit vehicle or by a human centrifuge device within the transit vehicle or surface habitat—has long been considered a potential solution. However, despite its attractiveness as an efficient, multisystem countermeasure and its potential for improving the environment and simplifying operational activities, we still have much to learn about the human response to rotating environments before successfully implementing AG.

The AG Research Project will be performed at Johnson Space Center, Ames Research Center, extramural academic and government research venues, and International Partner facilities maintained by the German Space Agency and the Institute of Medical and Biological Problems. The project includes three major ground-based human research subprojects that will lead to flight testing of intermittent short-radius AG in Space Station crewmembers after 2010, continuous long-radius AG in crew exploration vehicle crews transiting to and from the Moon, and intermittent short-radius AG plus exercise in lunar habitats. These human ground-based subprojects include:

- A directed, managed international short-radius project to investigate the multisystem effectiveness of intermittent AG in human subjects deconditioned by bed rest
- A directed, managed long-radius project to investigate the capacity of humans to live and work for extended periods in rotating environments
- A focused, investigator-initiated project to investigate system-specific adaptation to and from rotating environments.

The AG Research Project also includes two major animal research subprojects:

- A directed, managed ground-based subproject using rodents and, possibly, subhuman primates to address mechanistic issues that cannot be studied in humans, to rapidly develop higher sample numbers than can be achieved in the human subprojects, and to establish feasible parameter operating bands to reduce the breadth of the human subprojects
- A flight subproject using rodents to estimate the physiological effects of long-term exposure to hypogravity, and to investigate the effects of contamination by terrestrial gravity in estimating AG effectiveness. The animal flight subproject will be performed aboard the Space Station using the specific module in approximately the 2008–2011 timeframe.